

Potential implications of reduced tuberculosis vaccine efficacy in those with undernutrition on overall vaccine impact in India

Rebecca A. Clark¹, C Finn McQuaid², Roel Bakker², Kirankumar Rade³, Sanjay Kumar Mattoo⁴, Dheeraj Tumu⁴, Rein MGJ Houben², Richard G White¹

¹Department of Infectious Disease Epidemiology, LSHTM, London, UK; ²TB Modelling Group, LSHTM, London, UK; ³Independent Technical Consultant, New Delhi, India; ⁴Central TB Division, NTEP, MoHFW, Govt of India, New Delhi, India

Background: Nutritional status is a leading risk factor for tuberculosis (TB). In India up to half of all TB episodes are attributed to undernutrition. Given the impact of nutrition on the immune system, vaccine characteristics such as efficacy and duration of protection could vary depending on nutritional status. Therefore, previous vaccine impact estimates may be overestimated. We re-estimated vaccine impact in India with reduced efficacy with undernutrition.

Methods: We extended a previous model for India to incorporate BMI, using BMI <18.5kg/m² as a proxy for undernutrition. We estimated the potential impact of a vaccine preventing disease, with efficacy assumed to be 50% in those with normal BMI. We simulated scenarios with equivalent efficacy, reduced efficacy (25%), or no efficacy with undernutrition.

Preliminary Results: The model with no-new-vaccine predicted 22.9 million (95% uncertainty interval = 20.3–25.1) episodes and 4.4 million (4.0–4.8) deaths between 2030–2040, and approximately 15% of the population had a BMI < 18.5kg/m² in 2040. Preliminary results indicated that assuming equivalent vaccine efficacy, between 2030–2040, 3.5 million (3.0–3.9) episodes (~15% of total) and 472,900 (428,300–518,700) deaths (~20% of total) could be averted. If efficacy was decreased to 25% with undernutrition, 488,600 (429,400–540,200) fewer episodes and 71,600 (64,800–77,800) fewer deaths could be averted compared to equivalent efficacy. With no efficacy with undernutrition, 952,100 (837,500–1,053,400) fewer episodes and 139,700 (126,500–151,900) fewer deaths could be averted compared to equivalent efficacy.

Discussion: Given the population in India with undernutrition, if vaccine efficacy varies by nutritional status, it is important to account for this when estimating vaccine impact. Neglecting to account for differential efficacy with undernutrition could lead to an overestimation of cost-effectiveness and the amount of burden averted by vaccines.

Funding Sources

Not applicable

Conflicts of Interest

None

